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A2  
1. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops, wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said piezo-electric device further has a vibrating plate on one side of which said piezoelectric element is arranged, and a cavity forming member having a cavity which is arranged on the other side of said vibrating plate, and

wherein said vibrating plate can come in contact with said liquid in said liquid container via said cavity.

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13. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said ink container is an ink cartridge loaded on a carriage for moving said recording head back and forth in a removable state,

wherein said method comprises:

a consumption condition detection step of detecting, in a non-recording state of said

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recording head, said ink consumption condition in said ink cartridge by said piezo-electric device, and

a reconfirming step of redetecting said ink consumption condition in said ink cartridge by said piezo-electric device after detection of absence of ink in said ink cartridge by said consumption condition detection step;

wherein said reconfirmation step comprises:

a carriage moving step of moving said carriage after absence of ink in said ink cartridge is detected by said consumption condition detection step, and

a consumption condition redetection step of redetecting said ink consumption condition in said ink cartridge in a predetermined timing;

wherein said carriage moving step moves said carriage at a faster speed than a speed for moving said carriage during a recording operation.

14. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said ink container is an ink cartridge loaded on a carriage for moving said recording head back and forth in a removable state,

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wherein said method comprises:

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a consumption condition detection step of detecting, in a non-recording state of said recording head, said ink consumption condition in said ink cartridge by said piezo-electric device, and

a reconfirming step of redetecting said ink consumption condition in said ink cartridge by said piezo-electric device after detection of absence of ink in said ink cartridge by said consumption condition detection step;

wherein said reconfirmation step comprises:

a carriage moving step of moving said carriage after absence of ink in said ink cartridge is detected by said consumption condition detection step, and

a consumption condition redetection step of redetecting said ink consumption condition in said ink cartridge in a predetermined timing;

wherein a shock is given to said ink cartridge during moving said carriage by said carriage moving step.

15. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

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wherein said ink container is an ink cartridge loaded on a carriage for moving said recording head back and forth in a removable state,

wherein said method comprises:

a consumption condition detection step of detecting, in a non-recording state of said recording head, said ink consumption condition in said ink cartridge by said piezo-electric device, and

a reconfirming step of redetecting said ink consumption condition in said ink cartridge by said piezo-electric device after detection of absence of ink in said ink cartridge by said consumption condition detection step;

wherein said reconfirmation step comprises:

a carriage moving step of moving said carriage after absence of ink in said ink cartridge is detected by said consumption condition detection step, and

a consumption condition redetection step of redetecting said ink consumption condition in said ink cartridge in a predetermined timing;

wherein said consumption condition redetection step is executed when a predetermined time passes after said carriage moving step ends.

16. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-

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electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said ink container is an ink cartridge loaded on a carriage for moving said recording head back and forth in a removable state,

wherein said method comprises:

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a consumption condition detection step of detecting, in a non-recording state of said recording head, said ink consumption condition in said ink cartridge by said piezo-electric device, and

a reconfirming step of redetecting said ink consumption condition in said ink cartridge by said piezo-electric device after detection of absence of ink in said ink cartridge by said consumption condition detection step;

wherein said reconfirmation step comprises:

a carriage moving step of moving said carriage after absence of ink in said ink cartridge is detected by said consumption condition detection step, and

a consumption condition redetection step of redetecting said ink consumption condition in said ink cartridge in a predetermined timing;

wherein said consumption condition redetection step is executed during moving said carriage by said carriage moving step.

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19. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a

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recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said ink container is an ink cartridge loaded on a carriage for moving said recording head back and forth in a removable state,

wherein said method comprises:

a consumption condition detection step of detecting, in a non-recording state of said recording head, said ink consumption condition in said ink cartridge by said piezo-electric device, and

a reconfirming step of redetecting said ink consumption condition in said ink cartridge by said piezo-electric device after detection of absence of ink in said ink cartridge by said consumption condition detection step;

wherein said reconfirmation step comprises:

a carriage moving step of moving said carriage after absence of ink in said ink cartridge is detected by said consumption condition detection step, and

a consumption condition redetection step of redetecting said ink consumption condition in said ink cartridge in a predetermined timing;

wherein said reconfirmation step is executed several times during moving said carriage by said carriage moving step, and presence or absence of ink in said ink cartridge is decided on the basis of detection results of said reconfirmation steps.

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33. (Amended) An ink consumption condition detection method for detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops, wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said piezo-electric device has a vibration part including said piezo-electric element, and

wherein said piezo-electric device measures a periodic peak value of a waveform of counter electromotive force generated by residual vibration remaining in said vibration part by a predetermined number of said periodic peak values from a predetermined point of time, and said piezo-electric device measures more number of said periodic peak values than said predetermined number of said periodic peak values in subsequent detection of said ink consumption condition, and thereby detects said ink consumption condition.

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46. (Amended) An ink jet recording apparatus comprising:

a recording head configured to jet ink drops;

an ink cartridge configured to feed ink to said recording head;

a piezo-electric device having a piezo-electric element configured to detect an ink consumption condition in said ink cartridge, said piezo-electric device further having a vibrating plate on one side of which said piezo-electric element is arranged, and a cavity forming member



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having a cavity which is arranged on the other side of said vibrating plate, said vibrating plate being able to come in contact with said liquid in said liquid container via said cavity; and  
a control unit for controlling said piezo-electric device so as to detect said ink consumption condition when said recording head is in a non-recording state.

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49. (Once Amended) An ink jet recording apparatus according to claim 46, further comprising a storage unit for storing said ink consumption condition in said ink cartridge which is detected by said piezo-electric device.

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54. (Amended) An ink jet recording apparatus comprising:  
a recording head configured to jet ink drops;  
an ink cartridge configured to feed ink to said recording head;  
a piezo-electric device detecting an ink consumption condition in said ink cartridge;  
a control unit for controlling said piezo-electric device so as to detect said ink consumption condition when said recording head is in a non-recording state; and  
a carriage moving with said recording head and said ink cartridge both of which are loaded on said carriage,  
wherein said control unit controls said piezo-electric device so as to redetect said ink consumption condition in said ink cartridge after said piezo-electric device detects absence of ink in said ink cartridge when said recording head is in a non-recording state, and  
wherein said control unit moves said carriage after detection of absence of ink in said ink

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cartridge by said piezo-electric device and controls said piezo-electric device so as to redetect  
said ink consumption condition in said ink cartridge in a predetermined timing,  
said apparatus further comprising a shock unit configured to give a shock to said ink  
cartridge during movement of said carriage.

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Please add the following new claims:

55. (New) An ink jet recording apparatus according to claim 49, wherein said storage  
unit is mounted on said piezo-electric device.

56. (New) An ink jet recording apparatus comprising:  
a recording head for jetting ink drops;  
an ink cartridge for feeding ink to said recording head;  
a piezo-electric device for detecting an ink consumption condition in said ink cartridge;  
and  
a control unit for controlling said piezo-electric device so as to detect said ink  
consumption condition when said recording head is in a non-recording state,  
wherein said piezo-electric device has a piezo-electric element mounted on the outside of  
said ink cartridge.

57. (New) An ink detection method for detecting an ink consumption condition in an ink  
container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said piezo-electric device has a vibration part including said piezo-electric element,

wherein said piezo-electric device measures a periodic peak value of a waveform of counter electromotive force generated by a residual vibration remaining in said vibration part by a predetermined number of said periodic peak values from a predetermined point of time, and said piezo-electric device measures more number of said periodic peak values than said predetermined number of said periodic peak values in subsequent detection of said ink consumption condition and thereby detects said ink consumption condition, and

wherein said ink consumption condition in said ink container is detected using said piezo-electric device during maintenance operation for cleaning out ink in said recording head.

58. (New) An ink consumption condition detection method, comprising:

detecting an ink consumption condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said piezo-electric device has a vibration part including said piezo-electric

element,

wherein said piezo-electric device measures a periodic peak value of a waveform of counter electromotive force generated by residual vibration remaining in said vibration part by a predetermined number of said periodic peak values from a predetermined point of time, and said piezo-electric device measures more number of said periodic peak values than said predetermined number of said periodic peak values in subsequent detection of said ink consumption condition, and thereby detects said ink consumption condition,.

storing information of said ink consumption condition in said ink container detected by said piezo-electric device in a storage unit mounted on said ink container,

reading said information of said ink consumption condition stored in said storage unit, and

judging whether a detection of said ink consumption condition in said ink container should be executed or not on the basis of said read information of said ink consumption condition.

59 (New) An ink jet recording apparatus comprising:

a recording head for jetting ink drops;

an ink cartridge for feeding ink to said recording head;

piezo-electric device for detecting an ink consumption condition in said ink cartridge; and

a control unit for controlling said piezo-electric device so as to detect said ink consumption condition when said recording head is in a non-recording state,

wherein said piezo-electric device has a vibration part including a piezo-electric element,  
and

wherein said piezo-electric device measures a periodic peak values of a waveform of counter electromotive force generated by residual vibration remaining in said vibration part by a predetermined number of said periodic peak values from a predetermined point of time, and said piezo-electric device measures more number of said periodic peak values than said predetermined number of said periodic peak values in subsequent detection of said ink consumption condition, and thereby detects said ink consumption condition, and

a storage unit for storing said ink consumption condition in said ink cartridge which is detected by said piezo-electric device.

60. (New) An ink jet recording apparatus according to claim 59, wherein said storage unit is mounted on said ink cartridge.

61. (New) An ink consumption detection method according to claim 12 wherein a shock is given to said ink cartridge during moving said cartridge by said carriage moving step.

62. (New) An ink jet recording apparatus according to claim 53, further comprising a shock unit configured to give a shock to said ink cartridge during movement of said carriage.

63. (New) An ink consumption condition method for detecting an ink consumption

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condition in an ink container loaded in an ink jet recording apparatus having a recording head for jetting ink drops,

wherein said ink consumption condition in said ink container is detected using a piezo-electric device having a piezo-electric element during a non-recording state of said recording head,

wherein said ink consumption condition in said ink container is detected using said piezo-electric device during a maintenance operation for cleaning out ink in said recording head.

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